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Amanda Jensen
Indiana University

Reto Baertschiger
Dartmouth College

Jodi Hackworth
Indiana University Health

Fredrick Rescorla
Indiana University Health

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Blunt abdominal trauma with handlebar injury: A rare cause of traumatic amputation of the appendix associated with acute appendicitis

Amanda Jensen [a,b,*], Reto Baertschiger [a,d], Jodi Hackworth [c], Fredrick Rescorla [a]

[a] Division of Pediatric Surgery, Department of Surgery, Indiana University School of Medicine, Riley Hospital for Children at IU Health, Indianapolis, IN, USA
[b] Division of General Surgery, Department of Surgery, Indiana University School of Medicine, Indianapolis, IN, USA
[c] Department of Trauma Services, Riley Hospital for Children at IU Health, Indianapolis, IN, USA
[d] Section of Pediatric Surgery, Department of Surgery, Dartmouth Hitchcock Medical Center, Geisel School of Medicine at Dartmouth, Lebanon, NH, USA

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ABSTRACT

We describe traumatic appendicitis in a 7-year-old boy who presented after sustaining blunt abdominal trauma to his right lower abdomen secondary to bicycle handlebar injury. With diffuse abdominal pain following injury, he was admitted for observation. Computed axial tomography (CT) obtained at an outside hospital demonstrated moderate stranding of the abdomen in the right lower quadrant. The CT was non-contrasted and therefore significant appendiceal distention could not be confirmed. However, there was a calcified structure in the right pelvis with trace amount of free fluid. Patient was observed with conservative management and over the course of 15 h his abdominal pain continued to intensify. With his worsening symptoms, we elected to take him for diagnostic laparoscopy. In the operating room we found an inflamed traumatically amputated appendix with the mesoappendix intact. We therefore proceeded with laparoscopic appendectomy. Pathology demonstrated acute appendicitis with fecalith. It was unclear as to whether the patient's appendicitis and perforation were secondary to fecalith obstruction, his blunt abdominal trauma or if they concurrently caused his appendicitis. Acute appendicitis is a common acute surgical condition in the pediatric population and continues to be a rare and unique cause of operative intervention in the trauma population.

1. Background

Appendicitis is a common acute surgical problem occurring in approximately 7% of the Western population [1]. Appendicitis is caused by luminal obstruction, which subsequently leads to bacterial overgrowth. This overgrowth in the obstructed lumen leads to an inflammatory response that may lead to venous congestion, arterial insufficiency and eventual perforation [2,3]. It is known that luminal obstruction causes appendicitis however the cause has not always been clear. In approximately 20% of children, a fecalith is found to be the cause of obstruction. However, appendicitis has also been observed in the setting of lymphoid hyperplasia caused by an initial viral or bacterial infection, parasites, carcinoid tumors, and even foreign bodies in the appendix [4]. Trauma has also been reported very rarely in the literature as a cause of appendicitis [1,5]. In the setting of trauma, traumatic appendicitis is a rare cause of operative intervention. We present a very rare case of appendicitis after a bicycle handlebar injury. This case highlights the importance of early surgical management.

2. Case report

An otherwise healthy 7-year-old male presented to an outside emergency department (ED) with complaints of acute abdominal pain and nausea following blunt abdominal trauma. Earlier that evening the patient had been riding his bicycle when he got in an altercation with another child. In the process of falling off of his

Abbreviations: CT, computed axial tomography; ED, emergency department; RBC, red blood cell; NPO, nothing by mouth.

* Corresponding author. Indiana University School of Medicine, Department of Surgery, 545 Barnhill Drive, Emerson Hall 202, Indianapolis, IN 46202, USA. Tel.: +1 605 951 8689.
E-mail address: adorale@iupui.edu (A. Jensen).

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bike, he fell forward onto the handlebars. The bars hit him in the right lower abdomen as he fell to the ground. Initial vital signs were stable: temperature 37.3 °C, a heart rate of 111/min, blood pressure 115/82 mm Hg, respiratory rate of 17/min, and oxygen saturation of 100% on room air. On initial physical examination he had a classic handlebar sign with ecchymosis over the right lower quadrant with associated tenderness to palpation. He had no evidence of peritoneal signs. Initial lab work demonstrated a white count of 14.2 k/ml, hemoglobin of 11.7 GM/dl and platelet count of 291 k/ml. The urinalysis was also significant for gross hematuria (urine hemoglobin 300 Ery/uL and >100 hpf RBC). The patient subsequently underwent a non-contrasted CT of the abdomen and pelvis at the outside hospital which demonstrated moderate stranding in the anterior abdomen and right lower quadrant, most likely reflecting the patient's reported injury. The radiology report stated that significant appendiceal distention could not be confirmed. There was also a calcified structure in the right pelvis of uncertain location and significance and a trace quantity of free fluid in the inferior pelvis potentially reflecting minimal hemorrhage (Fig. 1A and B). The patient was subsequently transferred to our institution for dedicated pediatric trauma care.

On initial evaluation in our ED, the patient was nauseated and had one episode of emesis. He was unable to ambulate secondary to persistent abdominal pain. Therefore, he was admitted to the trauma service on the general surgical ward for serial abdominal exams on maintenance intravenous fluids with intravenous narcotics and nothing by mouth (NPO) status. No antibiotics were given at outside hospital or at our institution as we did not want to mask any symptoms of an intra-abdominal injury. On physical exam during surgical rounds early the next morning, approximately 12 h since time of injury, the patient was sleeping comfortably and tolerated exam without findings of peritoneal irritation. He did, however, complain of diffuse pain throughout the entire abdomen and was requiring intravenous narcotics for adequate pain control. Given the presence of hematuria on his initial urinalysis, a CT cystogram was obtained to assess for bladder injury (Fig. 1C). Results were negative for bladder injury and no appendiceal rupture was observed. However, there continued to be an 8 mm calcification in the right pelvis and a possible 2 cm disruption of the right anterolateral abdominal wall. Over the next several hours, the patient demonstrated worsening diffuse abdominal pain and on repeat physical exam he had peritoneal signs. Because of these findings and the potential for occult bowel injury, we decided to take the patient to the operating room for a diagnostic laparoscopy.

In the operating room, we initially identified a small amount of blood in abdominal cavity with a traumatic abdominal wall hernia in right lower quadrant. We subsequently identified a ruptured appendix, with significant periappendiceal inflammation also involving the terminal ileum. It had been traumatically amputated approximately 1.5 cm above its base (Fig. 2A). The mesoappendix was intact and attached to the amputated portion of the appendix, which was separated (Fig. 2B). Following further assessment, we did not see any further intestinal injury and subsequently proceeded with laparoscopic appendectomy. This was done using a stapling device. We elected not to repair his traumatic abdominal hernia at this time as it had disrupted all muscular and fascial layers of his abdominal wall. The patient was closed and transferred to the surgical floor. Post-operatively he was treated with piperacillin-tazobactam and was discharged on post-operative day three without complication. The appendix was submitted to pathology in two fragments. Pathology demonstrated acute appendicitis with the presence of a fecalith. In clinic follow up three months after injury, the patient was doing well and had no evidence of an abdominal wall hernia on ultrasound examination.

3. Discussion

Traumatic appendicitis has been sporadically reported in the literature over the last 100 years. It has been found to be a very rare cause of appendicitis. In review of the literature, there have been two different sets of criteria for diagnosis of traumatic appendicitis. The first, by Fowler states that in order to diagnose traumatic appendicitis there should be no previous history of appendicitis attacks, the cause of the trauma and mechanism of injury should create a force capable of reaching the appendix, the effects of trauma should be experienced immediately and merge into that of acute appendicitis [6]. Traumatic lesions of the appendix should be operatively demonstrated and therefore must be superimposed by acute inflammation of the appendix [6]. Ramsook also had similar thoughts and proposed the diagnostic criteria of 1) no history of abdominal pain before trauma, 2) there would be direct and violent blunt force to the abdomen of limited duration and 3) progressive worsening of signs and symptoms that merge into clinical presentation of appendicitis, confirmed by surgical intervention [5]. According to both Fowler and Ramsook, our patient would fit the criteria of traumatic appendicitis. What was different about this case, however, was that surgically our patient appeared to have traumatic amputation of the appendix.

In reviewing the literature on traumatic appendicitis, there were no other reported findings of traumatic amputation of the appendix causing acute appendicitis. In regards to etiology, three mechanisms for traumatic appendicitis have been described: 1) increased intra-abdominal pressure from direct injury, 2) blunt trauma causing direct effect on the appendix with subsequent edema and

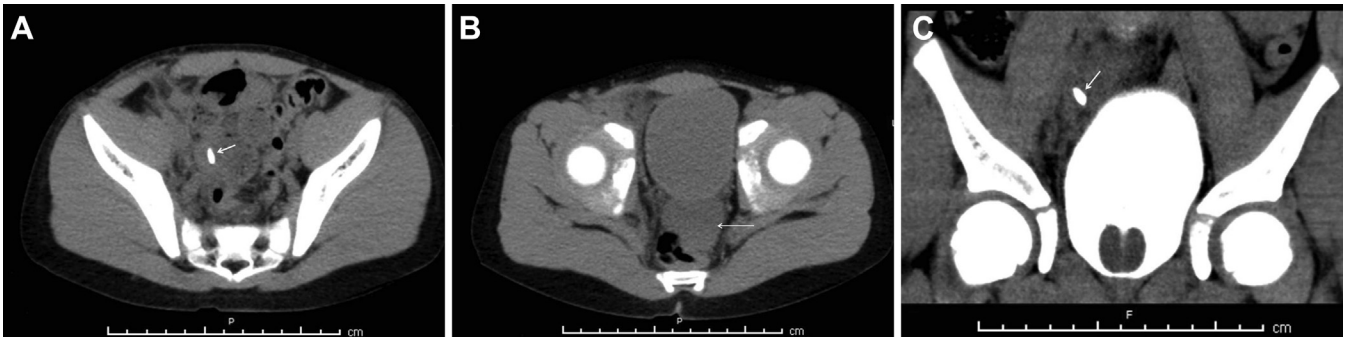

Fig. 1. Non-contrasted CT abdomen/pelvis (A, B) demonstrates moderate stranding in the anterior abdomen of the right lower quadrant. Significant appendiceal distention could not be confirmed. There was also a calcified structure in right pelvis of uncertain location and significance (A, white arrow). Trace quantity of free fluid in the inferior pelvis potentially reflecting minimal hemorrhage (B, white arrow). CT Cystogram (C) demonstrating no bladder injury and calcified structure in right pelvis (C, white arrow).

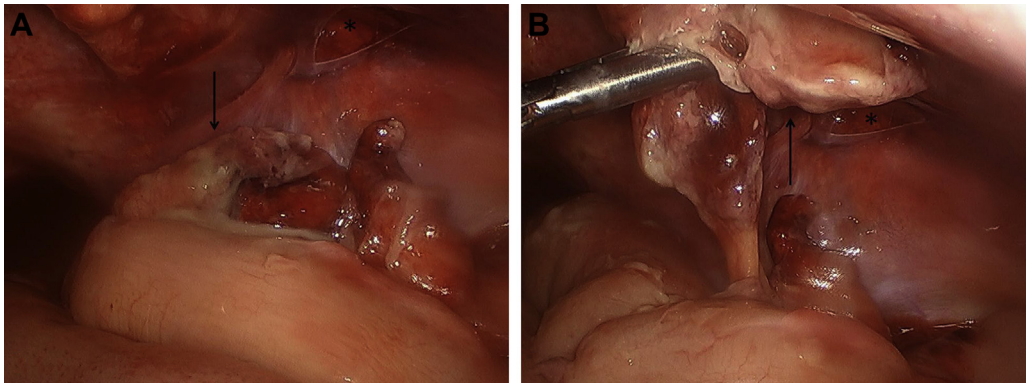

Fig. 2. Laparoscopic Images (A, B) Laparoscopy with visualization of traumatically amputated acute appendicitis (arrow). Above on the anterior abdominal wall the abdominal wall hernia can be visualized (asterisk).

inflammation, and 3) combination of appendiceal fecalith and cecal trauma [6,7]. It is difficult to identify which of these three mechanisms induced traumatic appendicitis in our patient. However, with the presence of a fecalith and direct blunt abdominal injury in his right lower quadrant, it was most likely a combination of all three etiologies.

Additionally our patient had a traumatic abdominal wall hernia (TAWH) that was initially treated non-operatively with plan for delayed repair. However, it had healed with unintentional non-operative management. Traumatic abdominal wall hernias are also a very rare occurrence in children. In a review of the literature by Talutis et al. all TAWH reported from 1956 to 2014 were reviewed. The majority of cases were secondary to handle bar injuries with 84.6% reported [8]. In their review, a majority of hernias were repaired open or laparoscopically, however, 5 of the 57 (8.77%) of TAWH were non-operative [8]. Case reports of TAWH with small defects following bicycle handle bar injury with follow up months later demonstrated no defect in the anterior abdominal wall with conservative management using an abdominal cotton corset for abdominal compression [8–10]. This would suggest that conservative management may be appropriate in patients with small defects.

Although rare, trauma continues to be a possible and very interesting cause of appendicitis that deserves to be in the differential diagnosis for cause of worsening abdominal pain following blunt abdominal trauma. Additionally, our experience with TAWH and the other few incidences of conservative management for small defects reported in the literature suggest that not only is it possible in children but that it should be considered in patients who are otherwise asymptomatic.

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Conflicts of interest

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